What is claimed is:

1. A ball bat including a barrel, a handle, and a tapered section joining the barrel to the handle, with the barrel comprising:

a substantially cylindrical outer wall including a first material located radially outwardly from a neutral axis of the outer wall, and a second material located radially inwardly from the neutral axis of the outer wall;

a substantially cylindrical inner wall separated from the outer wall by an interface shear control zone, the inner wall including a third material located radially outwardly from a neutral axis of the inner wall, and a fourth material located radially inwardly from the neutral axis of the inner wall;

wherein the first and third materials each have a specific energy storage in compression of at least 2000 psi, and the second and fourth materials each have a tensile modulus of at least 18 million psi.

2. The ball bat of claim 1 wherein the first and third materials each have a specific energy storage in compression of 2200 to 2400 psi.

3. The ball bat of claim 1 wherein the second and fourth materials each have a tensile modulus of 20 to 30 million psi.

4. The ball bat of claim 1 wherein the second and fourth materials each have a tensile specific energy storage of at least 1000 psi.

5. The ball bat of claim 1 wherein at least one of the first, second, third, and fourth materials comprises a fiber-reinforced resin composite material.

6. The ball bat of claim 5 wherein the composite material includes at least one material selected from the group consisting of glass, graphite, boron, carbon, aramid, and ceramic.

7. The ball bat of claim 1 wherein the first and third materials each comprise a structural glass-reinforced epoxy resin.

8. The ball bat of claim 1 wherein the second and fourth materials each comprise a graphite-reinforced epoxy resin.

9. The ball bat of claim 1 wherein at least one of the first, second, third, and fourth materials comprises a boron-reinforced epoxy resin.

10. The ball bat of claim 1 wherein the interface shear control zone comprises a layer of a bond inhibiting material separating the outer wall from the inner wall.

11. The ball bat of claim 10 wherein the bond inhibiting material comprises at least one material selected from the group consisting of a Teflon®, polymethylpentene, polyvinyl fluoride, a nylon, and cellophane.

12. The ball bat of claim 10 wherein the outer wall, the inner wall, and the layer of bond inhibiting material all terminate together at at least one end of the barrel.

13. The ball bat of claim 1 wherein the interface shear control zone comprises at least one of a friction joint, a sliding joint, and an elastomeric joint.

14. The ball bat of claim 1 wherein a fundamental hoop frequency of the outer wall is within 20% of a fundamental hoop frequency of the inner wall.

15. The ball bat of claim 14 wherein the fundamental hoop frequencies of the outer and inner walls are each in a range of 1000 to 1200 Hz.

16. A ball bat including a barrel, a handle, and a tapered section joining the barrel to the handle, with the barrel comprising:

a substantially cylindrical outer wall; and

a substantially cylindrical inner wall located within the outer wall, wherein the outer wall and the inner wall blend together at at least one end of the barrel.

17. The ball bat of claim 16 further comprising an interface shear control zone separating the outer wall from the inner wall, such that the outer wall is divided into a first outer section and a first inner section by a first neutral axis, and the inner wall is divided into a second outer section and a second inner section by a second neutral axis.

18. The ball bat of claim 17 wherein the first and second outer sections each include a material having a specific energy storage in compression of at least 2000 psi, and the first and second inner sections each include a material having a stiffness of at least 18 million psi.

19. The ball bat of claim 17 wherein the materials in the first and second outer sections each comprise a structural glass-reinforced epoxy resin.

20. The ball bat of claim 17 wherein the materials in the first and second inner wall sections each comprise a graphite-reinforced epoxy resin.

21. The ball bat of claim 17 wherein the interface shear control zone comprises a disbonding layer separating the outer wall from the inner wall.

22. The ball bat of claim 21 wherein the outer wall, the inner wall, and the disbonding layer all blend together at at least one end of the barrel.

23. A ball bat including a barrel, a handle, and a tapered section joining the barrel to the handle, with the barrel comprising:

a substantially cylindrical first wall including a first material located radially outwardly from a neutral axis of the first wall, and a second material located radially inwardly from the neutral axis of the first wall;

wherein the first material has a specific energy storage in compression of at least 2000 psi, and the second material has a tensile modulus of at least 18 million psi.

24. The ball bat of claim 23 further comprising a substantially cylindrical second wall located within the first wall.

25. The ball bat of claim 24 wherein the second wall is separated from the first wall by a first interface shear control zone.

26. The ball bat of claim 25 further comprising a substantially cylindrical third wall located within the second wall.

27. The ball bat of claim 26 wherein the third wall is separated from the second wall by a second interface shear control zone.

28. A ball bat including a barrel, a handle, and a tapered section joining the barrel to the handle, with the barrel comprising:

a substantially cylindrical outer wall;

a substantially cylindrical inner wall located within the outer wall;

an interface shear control zone separating the outer wall from the inner wall, such that the outer wall is divided into a first outer section and a first inner section by a first neutral axis, and the inner wall is divided into a second outer section and a second inner section by a second neutral axis;

wherein the first and second outer sections each include a structural glass epoxy, and the first and second inner sections each include a graphite epoxy.